Taylor Larrechea
10:00 - 10:50 AM
Phys - 131

Supp Ex : 34, 35, 39
Ch 6 Conc. Q 14
Ch 6 Probs : 29, 49, 57, 58

14.5
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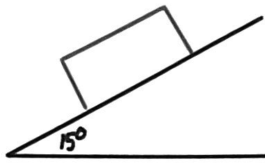
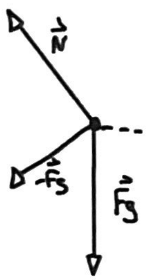
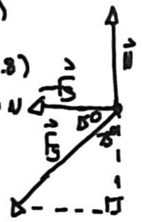
Ch 6. Problems

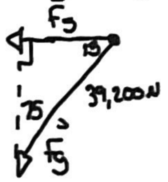
29.) $m = 4000$ kg
15° Slope
$\mu_s = 0.90$





$\vec F_g = m(g)$
$\vec F_g = 4000(9.8)$
$\vec F_g = 39{,}200$ N





Newtons 2nd Law
$\Sigma_x = 0$
$\Sigma_y = 0$

F	x	y
$\vec N$	0	N
$\vec f_s$	$-f_s$	0
$\vec F_g$		

X comp = 39,200 sin 15
Y comp = 39,200 cos 15

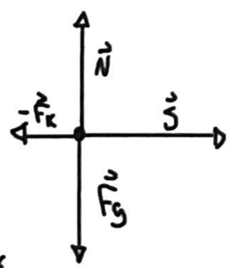
$N - 39{,}200\cos 15$
$N = 39{,}200\cos 15$

$-\vec f_s + 39{,}200\sin 15 = 0$
$\vec f_s = 39{,}200\sin 15$
$\vec f_s = 10{,}145.7$ N

3/3

$\vec f_s = 10{,}145.7$ N

49.) $m = 75$ kg
Ski $= 200$ N
$\mu_k = 0.1$
$t = 10$ s



$\vec S$ = Ski vector

$\Sigma_x = ma_x$
$\Sigma_y = ma_y$

F	x	y
$\vec N$	0	N
$\vec F_g$	0	$-mg$
$\vec F_k$	$-\vec F_k$	0
$\vec S$	$\vec S$	0

$V_1x^2 = V_0x^2 + 2a_x\Delta x$
$(16.9\,m/s)^2 = (0\,m/s)^2 + 2(1.69\,m/s^2)\Delta x$
$285.61\,m/s = 3.38\,m/s^2\,\Delta x$
$\Delta x = 84.5$ m

$\mu_k(\vec N) = \vec F_k$
$0.1(735) = 73.5$ N

$200\,N - \vec F_k = ma_x$
$N - mg = 0$
$N = mg$
$\vec N = 75\,kg(9.8\,m/s^2)$
$\vec N = 735$ N

$-73.5\,N = ma_x$
$\frac{-73.5\,N}{75} = a_x$
$a_x = -0.98\,m/s^2$

$200\,N - 73.5\,N = ma_x$
$126.5 = 75\,kg \cdot a_x$
$a_x = 1.69\,m/s^2$

$V_1x = V_0x + a_x\Delta t$
$V_1x = 0\,m/s + 1.69(10)$
$V_1x = 16.9\,m/s^2$
$V_1x = 16.9\,m/s^2$

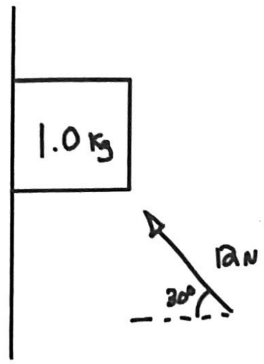
$V_1x^2 = V_0x^2 + 2a_0x\Delta x$
$(0\,m/s)^2 = (16.9\,m/s)^2 + 2(-0.98\,m/s^2)\Delta x$
$-285.61\,m/s = -1.96\,m/s^2\,\Delta x$
$\Delta x = 145.72\,m + 84.5\,m$
$\Delta x = 230.22$

$a_0x = 1.69\,m/s^2$
$a_1x = -0.98\,m/s^2$

$V_1x = 16.9\,m/s^2$
$\Delta x = 230.22$ m

57.)

F	x	y
$\vec{F}_g$	0	$-mg$
$\vec{N}$	N	0
$\vec{12N}$	$-12\cos 30$	$12\sin 30$
$\vec{f}_s$	0	$\vec{f}_s$



x-comp = 12N cos30
y-comp = 12N sin30

$N - 12\cos 30 = 0$

$N = 12\cos 30$

$\Sigma_y = 12\sin 30 - mg$

12sin30 represents motion of block upward

$12\sin 30 = \boxed{6N \text{ upward}}$

$\vec{f}_s + 12\sin 30 - mg = 0$

$\vec{f}_s + 6 - 9.8 = 0$

$\vec{f}_s - 3.8 = 0$

$\boxed{\vec{f}_s = 3.8N \text{ upward}}$

$-mg$ represents motion of block in the downward direction

$\vec{f}_{s\,max} = \mu_s n$

$m = 1.0\,kg$

$g = 9.8\,m/s^2$

$-(1.0\,kg)9.8\,m/s^2 = -9.8N$

$\boxed{9.8N \text{ Downward}}$

Σ_x: $N - 12\cos 30 = 0$

$N = 12\cos 30$

$N = 10.4N$

$3.8 = \mu(10.4N)$

$\mu_s = 0.35$

6N up + 3.8N up = 9.8N Down

9.8N up = 9.8N Down

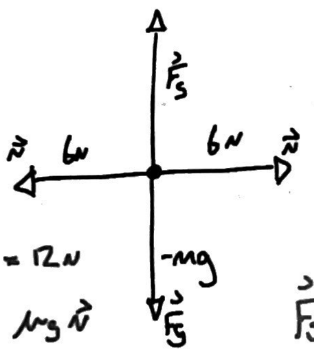
0

The block will stay at rest due to the sum of the upward forces cancelling out the force of gravity.

58.)

$\vec{N} = 6.0N$

$\mu_s = 0.80$



$\vec{N} = 6N + 6N = 12N$

Static max = $\mu_s \vec{N}$

μ_s 12N

0.80 (12N)

9.6N

$\vec{F}_s = mg$

$\vec{F}_s = mg$

$9.6N = m(9.8\,m/s^2)$

$\frac{9.6N}{9.8\,m/s^2} = m$

$m = 0.98\,kg$

The heaviest book that can be held before the static friction max being surpassed is 0.98 kg

6. Concept questions

14.) $F = ma$ $t = 1.0s$

when m when 2m

$\frac{F}{m} = a$ $\frac{F}{2m} = a$

1 $\frac{1}{2}$

a.) When the mass is 2m, the acceleration with the same applied force is ½ that of when the mass is m. Therefore it will take twice as long for the mass of 2m to reach the same velocity as when the mass is m. In this case of a (1s) time of applied force, it would take 2 seconds for the mass of 2m to reach the same velocity as the mass of m.

Initial velocity of zero

$d = \frac{1}{2}(a)\Delta t^2$ $d = \frac{1}{2}(a)\Delta t^2$

$d = \frac{1}{2}(a/2)\Delta t^2$ $d = \frac{1}{2}(a/1)\Delta t^2$

$d = a/4\ \Delta t^2$ $d = a/2\ \Delta t^2$

b. $T = \sqrt{2t^2}$

$\Delta t^2 = 4/a(a/2)\Delta t^2$

$\Delta t^2 = 2\Delta t^2$

$\Delta t = \sqrt{2t^2}$

34 Free fall in an elevator

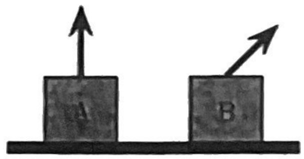
A phone of mass m sits on the floor of an elevator, which is initially at rest. The elevator cable snaps and the elevator and phone then undergo free fall. While they do this which is true of the magnitude of the normal force, n, acting on the phone? Explain your choice.

i) $n = 0$.
ii) $mg > n > 0$.
iii) $n = mg$.
iv) $n > mg$

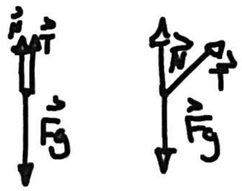
Once the cable Snaps, the elevator and everything inside it is in free-fall. Both objects will be accelerating at the acceleration of gravity, therefore the phone be "weightless" thus $mg=0 \therefore N=0$

35 Normal forces

Two identical boxes are at rest on a rough horizontal surface. A person pulls on each with the same force but in different directions on the boxes. On box A it pulls vertically and on box B it pulls at an angle of 45° from the vertical. Which of the following is true regarding the normal force exerted on A and that exerted on B? Explain your choice.



i) $n_A = n_B$.
ii) $n_A < n_B$.
iii) $n_A > n_B$.



The tension component in the y direction will relieve the force of mg on the Surface, for Box A tension in the y-direction $= \vec{T}$. For box b, the tension force in the y-direction would be Tsin45, thus tension of Box A is greater than Box B relieving more of the force of gravity. $\vec{N} = mg$, box B will have a greater $\vec{N}$.

2.5 / 3

Not a physics explanation
Need $\Sigma F_y = ma_y = 0$ ...
-(0.5)

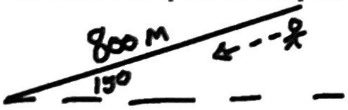
39 Sledding on a slope

A person in a sled is at rest at the top of a slope that is angled 15° above the horizontal. The length of the slope is an 800 m (about 0.5 mi). The combined mass of the person and sled is 90 kg. They are released from the top of the slope and slide straight down without pushing. While this happens the air exerts a constant force of 150 N exactly opposite to the direction in which they move.

a) Determine the acceleration of the person and sled. *You must solve this by starting with a FBD, using Newton's second law, finding components,.... Simply looking up a formula is not adequate.*

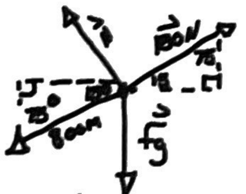
b) Determine the time taken for the person and sled to reach the bottom of the slope.

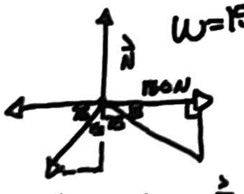
c) Determine the speed of the person and sled at the bottom of the slope.



$M = 90 kg$

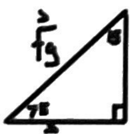
F	X	Y
$\vec{N}$	0	N
$\vec{F_g}$	-882sin15	-882cos15
$\vec{W}$	150N	





$W = 150N$

$\vec{N}$=norm
$\vec{F_g}$=gravity
$\vec{w}$=wind



$y = \vec{F_g}\cos$
$\cos 15$
$90kg \cdot 9.8 \cos 15$
$882\cos 15$
-851.95

$x = \vec{F} \sin 15$
$x = (m \cdot g)\sin 15$
$x = (90kg \cdot 9.8)\sin 15$
$x = 882\sin 15$
$x = 228.28$

$\Sigma_x = Ma_x$
$\Sigma_y = 0$

$\Sigma_x : 150N - 882\sin 15 = ma_x$
$-78.28 = ma_x$
$a_x = -0.87 \, m/s^2$

$N = 882\cos 15$
$\vec{N} = 851.95 N$

$\Delta x = 800m$
$a_x = -0.87 m/s^2$
$\Delta x = V_{0x}\Delta t + \frac{1}{2}a_x \Delta t^2$
$V_{0x} = 0 m/s$
$800m = 0(\Delta t) + \frac{1}{2}(-0.87)\Delta t^2$
$800m = -0.432 \, a_x \, \Delta t^2$
$\Delta t^2 = -1851.85$
$\Delta t = 43.03$

a.) $a_x = -0.87 m/s^2$

b.) $\Delta t = 43.03$

c.) 37.41 m/s

$V_{1x} = V_{0x} + a_x\Delta t$
$V_{1x} = 0m/s - 0.87(43)$
$V_{1x} = 37.41$